

# Forest Health Protection

## Pacific Southwest Region



Date: September 29, 2002  
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To: District Ranger, Warner Mountain Ranger District, Modoc National Forest  
Subject: Prescribed Fire Effects in the Sugar Hill Plantation (FHP Report NE02-10)

At the request of Bill Merrihew, Forest Silviculturist, I participated in a District field meeting at the Sugar Hill Plantation Prescribed Burn on September 17, 2002. Several Modoc National Forest personnel were present including Edie Asrow, District Ranger, Cathy Carlock, District Culturist, and Jim Hill, prescribed fire burn boss. Dave Evans, Forest silviculturist (Lassen NF), accompanied me to the meeting. The objectives of my visit were to assess the extent of fire-related injury to trees, determine bark beetle presence and level of activity, discuss the influence of the various insect attacks on tree survival and provide recommendations for reducing the amount of fire-related injury to conifers in future prescribed fires as appropriate.

### Background

The Sugar Hill prescribed fire area is located on the west slope of the Warner Mountains within the 16" to 20" annual precipitation zone. The plantation consists of 60-year-old Jeffrey pine that were established following a stand replacing fire. Trees range in size from 6" to 16" dbh and are growing at a density of approximately 110 trees/acre. Site class is a Dunning 3 to 4. Previous management activities within the burn unit include a pre-commercial thinning where the trees were sheared and chipped ten years ago. Whole tree yarding resulted in the removal of most understory vegetation and duff. Pre-burn fuels consisted of 1 - 4 inches of fine material

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**NORTHEASTERN CALIFORNIA SHARED SERVICE AREA**  
**2550 RIVERSIDE DRIVE**  
**SUSANVILLE, CA 96130**  
**530-257-2151**

**Sheri Lee Smith**  
Supervisory Entomologist  
[ssmith@fs.fed.us](mailto:ssmith@fs.fed.us)

**Danny Cluck**  
Entomologist  
[dcluck@fs.fed.us](mailto:dcluck@fs.fed.us)

**Bill Woodruff**  
Plant Pathologist  
[wwoodruff@fs.fed.us](mailto:wwoodruff@fs.fed.us)

consisting of needles, twigs and cones. Pre-burn inventories revealed the average height of lower crowns to be 10 feet.

This unit was burned on October 14, 2001 and was the first of five in the Sugar Hill plantation to be treated over the next few years. The objectives for the burns are to enhance and maintain a diverse and sustainable ecosystem by reducing the severity of future wildland fires, protect and improve plantation investments, wildlife habitat and rangeland condition and to re-introduce fire in historically fire-dependent ecosystems. The range of acceptable results included up to 5 % mortality of crop trees (Prescribed Fire Plan 5/10/2000).

### **Observations**

Examinations of several trees within the burn unit revealed limited fire-injuries. Needle scorching was evident throughout the stand but seldom occurred on over 50% of the pre-fire crowns. The exceptions were in small pockets, less than ½ acre, where crown scorch ranged up to 100 %. In most trees, due to the season of burn, crown scorch did not correlate with actual crown kill, as many buds were not damaged. Evidence of new green needles revealed that many of these scorched trees had enough remaining live crown to survive if cambium damage is not severe.

Cambium damage appeared to be minimal in most trees and was not consistent with bark scorch. Complete consumption of surface fuels around the bases of trees resulted in bark scorch that frequently reached up into the crown. Several trees that had significant bark scorch were sampled and found to have live cambium underneath. Higher amounts of dead cambium were noted on the uphill side of pines growing on slopes. Even in these trees cambium damage was most likely less than 40 % of the total bole circumference.

Insect activity in the stand was limited to red turpentine beetles (*Dendroctonus valens*) and flatheaded wood boring beetles (Family Buprestidae). Red turpentine beetle pitch tubes were found mostly at ground level on trees that had higher amounts of cambium damage and/or crown scorch. Wood boring beetle activity was limited to trees that had excessive fire-injuries to both the cambium and the crown. Jeffrey pine beetle activity was not evident.

Many trees had numerous clear pitch streamers higher in the boles. These pitch streamers occurred during the burn as the heat accumulated near the bole and fire climbed up the bark. Even though some of these pitch streamers may resemble bark beetle pitch tubes, they are not the result of post-fire insect activity.

### **Discussion**

It appears that the prescribe fire in this unit met the objectives as stated in the burn plan. Most surface fuels were consumed and branch wood and needle foliage on the lower 1/3 of the tree canopies were scorched to partially consumed. Crown scorch may have been more severe than expected but this was most likely due to the fire weather conditions; low fuel moisture, low live fuel moisture, and low humidity combined with low wind speed. The lack of wind may have allowed the heat to remain under the trees for an extended period of time resulting in the observed crown scorch and needle consumption. Trees experiencing water stress, as indicated

by the observed low live fuel moisture for Sugar Hill, may be less resistant to prolonged heating of the foliage.

Cambium damage appeared to be minimal. This is most likely due to the limited amount of duff that had accumulated around these trees since the whole tree yarding effectively swept the unit ten years ago. When damage did occur it was mostly related to areas where the heat had accumulated and fire had climbed up the bole such as the uphill side of trees growing on slopes.

Most mortality that will occur within the burn unit will be observed within the next 2-3 years. This mortality should be minimal, as trees appear to have incurred only minor fire-related injuries. Recent Forest Health Protection monitoring studies of fire-damaged trees in the Sierra Nevada indicate that ponderosa and Jeffrey pine can survive scorch of up to 90 % of the pre-fire crown provided that the actual amount of crown kill is less than 65 %. These species can also survive a significant amount of cambial damage as well. In the field, damage can be assessed by sampling the cambium at four equidistant locations around the bole at ground level. The same FHP monitoring studies have shown that trees < 20" dbh can survive with < 2 dead samples and trees > 20" dbh can survive with < 3 dead samples.

The level of observed insect activity was similar to that observed in other prescribed burns throughout the Sierra Nevada and southern Cascades over the past few years. The presence of red turpentine beetle attacks, large red pitch tubes at the base of pines, is common in post-burn stands, as the adults of these beetles are attracted to trees with fire-related injuries. Once a suitable host is found they produce an aggregation pheromone to attract additional beetles to the tree. Although attacks can be numerous on a given tree the rate of associated mortality is generally low. In the prescribed fires and wildfires visited over the past few years the mortality that occurred was primarily caused by fire-related injuries as opposed to bark beetle attacks. Wood boring beetles, identified by the presence of large larvae feeding randomly within the cambium/phloem layer, are also commonly found in the dead, dying and weakened trees. These trees typically have incurred severe fire-related injuries.

The level of post-fire activity for bark beetle species such as Jeffrey pine beetle, western pine beetle, and mountain pine beetle generally depends on many factors. Variables include the season, intensity and duration of the burn, the precipitation regime, stand characteristics, and the level of bark beetle activity in the general area prior to the burn. Due to the low amount of precipitation experienced in the region over the past three years bark beetle related mortality has been elevated. For example, higher levels of mortality associated with western pine beetle have been noted throughout northeastern California. For the Sugar Hill burn some bark beetle related mortality could be expected until precipitation levels return to normal. However, bark beetle related mortality levels within the burned area are not likely to be much different than those found in the surrounding areas.

This burn unit contained the least amount of fuel out the five units proposed for treatment over the next few years. If the other units have significantly more fuel and the prescribed burns are carried out under similar conditions (low fuel moisture, low live fuel moisture, low humidity, and low wind speed), higher levels of fire-injury are likely to occur. In the plantation units with significant ladder fuels, crown scorching may be severe. This is especially true for water

stressed trees that are in the process of shedding older needles. Mortality from fire-related injuries would be expected for trees that meet the criteria listed above for cambium and/or crown kill.

For areas with higher amounts of fuel it may be necessary to perform a pre-burn treatment such as brush mastication or a pre-commercial tree thinning. If brush is masticated it may be necessary to rake some of the chips away from the bases of trees that are to be maintained as residuals or allow enough time between mastication and the underburn to allow the chipped material to decompose enough to alter the flammability and heat intensity.

Forest Health Protection can assist with the funding for thinning and removal of material from overstocked plantations in the Sugar Hill area. If you are interested in this funding please contact any of the Forest Health Protection entomology staff for assistance in developing and submitting a proposal.

If you have any questions regarding this report and/or need additional information please contact me at 530-252-6431 or at [dcluck@fs.fed.us](mailto:dcluck@fs.fed.us).

Daniel R. Cluck  
Entomologist  
Forest Health Protection  
NE CA Shared Service Area